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COLONIAL AGRICULTURE.

THE Conference of Colonial Directors of Agriculture which was held in London last summer afforded a useful opportunity for reviewing many important problems in the work of Colonial Agricultural Departments. The Conference was not only attended by the directors and deputy directors of agriculture from practically every British Dependency but also by a representative of the Union of South Africa, by officers of the Imperial Agricultural Bureaux and by leading authorities on agriculture, forestry and medicine in Great Britain. The subjects discussed included the work of the Imperial Agricultural Bureaux, soil conservation, animal husbandry, nutrition, land settlement, produce inspection, agricultural education and publicity. The Conference's conclusions and recommendations which are set out in its report* may briefly be reviewed here.

No suggestions of major importance were made concerning the manner in which the functions of the Bureaux were performed so far as the Colonial Empire was concerned. It was recommended, however, that somewhat fuller abstracts of papers which appear in publications normally difficult of access to workers in the Dependencies might be provided, and that lists of publications received by Colonial departments might with advantage be supplied to the Bureaux. The continued issue of critical reviews of certain aspects of agricultural research would be welcomed. The preparation of lists, of the recognised and established commercial varieties of the more important tropical and sub-tropical crops grown in the different territories in the Empire for use by research workers engaged in plant improvement problems, was also recommended for consideration. The Conference stressed the importance of active measures being taken to control the losses caused by termites and expressed the hope that the Executive Council of the Bureaux might take such steps as would lead to the collection and interchange of information on termites with a view to establishing the distribution of the most dangerous and destructive species.

The Conference gave soil conservation an early and prominent place in its discussions. In many colonial dependencies considerable attention has been paid to this problem and measures have already been taken for preventing and checking

* Report and Proceedings of the Conference of Colonial Directors of Agriculture held at the Colonial Office, July, 1938. (Colonial No. 156, 1938.) (London : H. M. Stationery Office, 1938.) 2s. od. net.

accelerated erosion and maintaining soil fertility. It was felt, however, that efforts in this direction were unlikely to be successful unless a policy of close collaboration was established between the administration, all Government technical departments, all local authorities and also the people themselves. The need for establishing such a policy and for creating an informed public opinion was strongly emphasized. Since administrative officers will be mainly responsible for the carrying out of soil conservation programmes the Conference recommended that the subjects of land utilization and of soil conservation should occupy a leading place in the university courses for these officers. Improved pasture management was considered important in those dependencies where soil losses result from over concentration of stock and lack of grazing control. In grassland areas the controlled movements of stock, controlled grazing and control over grass and bush burning are advocated as essential for conservation.

The Conference expressed complete unanimity on the value of mixed farming in tropical agriculture, while recognizing the immense economic and psychological difficulties that its general adoption would involve. The promising development of mixed farming in the Northern Provinces of Nigeria was noted and while certain trials had been initiated elsewhere, it was felt that further efforts should be made to test the feasibility of introducing animal husbandry into systems of agriculture wherever practicable. The expansion of mixed farming is to be encouraged by financial assistance from Colonial Governments in proportion to the farmers' capacity to repay. It is hoped that means, such as co-operative thrift societies will be devised to enable "prospective" mixed farmers to effect savings and purchase the necessary stock and implements. Among other forms of Government assistance suggested are the provision of veterinary services for the immunization of stock required by mixed farmers and for detection of diseases, and the development of market centres and schemes for the orderly marketing of produce.

With regard to nutrition the Conference attached importance to the need for a greater consumption of meat and other animal products, fruit and green vegetables if the nutritional standards of the people of the Colonial Empire are to be raised. In tackling the nutritional problem the closest co-operation between the medical, agricultural, veterinary and education departments is advocated. Departments of Agriculture are urged to give greater attention to the development of vegetable gardens, to the production of greater supplies, and to the greater diversification, of locally grown foodstuffs. In all territories where rice is the staple food of diet it is hoped that endeavours will be made to encourage the use of under-milled or good quality par-boiled rice in the place of polished white rice.

Although it was recognized that land settlement could do much to alleviate certain social difficulties it was felt that there are certain limits to its possibilities and that failure to appreciate and to take account of them can only lead to disappointment and failure. In the launching of land settlement schemes it was urged that all factors involved, such as the suitability of the land, the accessibility to transport facilities and to market centres, the system of land tenure, the selection of settlers and their supervision by qualified officers, the types of suitable crops that can be grown, should all be carefully examined. Wherever possible also it was considered that surveys of the economics of peasant agriculture should be undertaken prior to the inception of land settlement. In view of the many examples in the past of the folly of establishing land settlement schemes on unsuitable lands without adequate preliminary enquiries or without the provision of continued instructions for settlers, it was recommended that all necessary measures should be taken to avoid the repetition of these mistakes in the future.

A good deal of progress has been made in the development of schemes for the inspection of agricultural produce in a number of dependencies since the last Conference in 1931. While advocating the extension of these schemes where possible, the Conference emphasized that the support of trade interests, propaganda, and the careful examination of market requirements, were all essential to their success.

In respect of agricultural education and training the Conference recorded that much progress is being made as a result of the growing co-operation between agricultural and educational departments throughout the Colonial Empire but that there are still difficulties with regard to bridging the gap between the education of the young agriculturist and his establishment as a farmer. Definite progress is recorded in the training of subordinate staffs for Departments of Agriculture but the Conference insists that in future steps should be taken to ensure that scholars admitted to vocational agricultural schools or colleges should have a rural background or outlook. The Conference welcomed the steps which have been taken by the Imperial College of Tropical Agriculture to provide special courses of training for selected subordinate officers in Colonial Departments of Agriculture with a view to fitting them for promotion to higher staff appointments.

The Conference was of the opinion that close attention to propaganda and publicity is necessary if satisfactory progress in extension work is to be achieved. Several systems were examined and although there was considerable divergence of opinion on the value of certain types of films and, in certain dependencies, of broadcasting, it was felt that both methods and, in addition, lantern slides with a spoken commentary could form a useful adjunct for reinforcing normal extension activities and attracting attention to them. These forms of propaganda, however, must be followed up closely by extension workers if a lasting measure of success is to be secured. The Conference attached importance in particular to demonstrations and lectures at district shows,

village council meetings, and schools, and to the organization of visits to agricultural and demonstration stations and selected farms.

The most striking feature of the Conference was the repeated emphasis laid by Colonial delegates on the need for placing the land first in formulating agricultural policy. That the rights of the soil have been neglected hitherto is shown by such unmistakable signs as widespread exhaustion and erosion. The urgent need for remedying this state of affairs is every day becoming more apparent and unless prompt and farsighted action is taken most Colonial Governments will sooner or later be faced with the hard fact of rapidly dwindling land resources. Soil depletion ultimately means the end of all hopes of raising standards of living, improving nutrition and producing healthy, prosperous citizens. Of course, the dangers of soil erosion and the importance of soil conservation are fully realised but while much work has already been started to check these dangers, much still remains to be done. The key points in the reform of tropical agriculture seem to be soil conservation, mixed farming and nutrition, and if the recommendations made by the Conference on these subjects are carried out there will surely be an improvement in the methods of developing the natural resources of the tropics and in the standard of life of the native populations.

PRODUCTION AND UTILIZATION OF BANANA FIBRE.*

THE possibility of extracting the fibre from the stems which are cut down after harvesting the fruits of the edible banana has long attracted interest, especially as this waste material is normally either burnt or dug into the ground as manure. In spite of the attention which this fibre has received, however, it is still used only locally by natives for making ropes, mats, hats and similar articles, and, apparently, it has never been extracted on any large commercial scale. The same is true also of the fibres of a number of wild species of banana which have been subjected to investigation at different times.

The fibres derived from both the cultivated and wild species of banana are similar in character to manila hemp, which is obtained from a closely related plant. There appears to be considerable variation in the quality and strength of banana fibre from different sources even when derived from the same species and reports as to the value of the fibre are often contradictory. In some cases it has been found that the fibre yielded is of poor quality and too weak for cordage manufacture, while in others it was comparable with good quality manila hemp. This conflicting evidence may be explained partly by the variation in the fibre properties of plants at different stages of maturity. It is said that, as a rule, the strength of the fibre improves up to the time of flowering, after which there is a tendency to woodiness in the stem which affects both the quality of the fibre and the ease of extraction. It is, therefore, not possible in the case of bananas grown for fruit to extract the fibre until well after the optimum period.

Among the favourable reports which have been published may be mentioned that of R. O. Bishop in Malaya. He found that the cultivated varieties yielded a fibre superior in quality to that of the wild native species, and resembling the medium grades of "partially cleaned" commercial manila hemp. It is also recorded that in Cuba banana fibre has been successfully converted on an experimental scale into sacks for sugar, for which purpose it proved superior to jute.

Fibre of good quality, in some cases comparable with high grade manila hemp, has also been obtained from certain wild species of banana growing in East Africa, notably *Musa ensete* and *M. ulugurensis* from Tanganyika and a species from Kenya (probably *M. livingstonia*). These fibres have been examined at the Imperial Institute and reports on their quality and value appeared in this Bulletin, Vol. III, No. 3, 1905, p. 226 (*M. ensete* and *M. ulugurensis*), and Vol. V, No. 3, 1907, p. 228 (*M. livingstonia*). *M. ensete* and *M. livingstonia* appeared the most promising, yielding fibres which, in the opinion of commercial experts, were suitable for rope-making and would find a ready sale in the London market at that time, in competition with manila hemp.

There seems little doubt that good quality fibre suitable for cordage purposes can be obtained from various species of banana. Furthermore, it has been found that such fibre can be converted into a pulp which yields a strong wrapping paper. The two factors which militate against the more extensive production of the fibre are the difficulty of extraction and the very low yield of fibre. As yet no machine has been found which will extract the fibre satisfactorily, and the use of hand labour is therefore necessary. This difficulty is further accentuated in the case of the cultivated banana owing to the late harvesting of the stems, which are therefore of a coarse and woody nature. Machines of a simple kind are used in the Philippines for the extraction of manila hemp, but much of this fibre is still prepared by hand. This is possible because the yield of fibre is so much higher than in the case of the banana. Whereas a single stem of the manila hemp plant, which weighs from about 90 to 220 lb. when freshly cut, gives from 1 to 5 lb. of dry fibre, Bishop found the yield from a stem of cultivated banana, weighing from 40 to 80 lb. in the fresh state, to be only from 1 to 4 oz. This very low fibre content would preclude the use of the stems for paper-making; it has been estimated that 132 tons of green stems would be needed to produce 1 ton of paper.

On two estates in the Philippines power machinery is employed for decorticating manila hemp. It is understood that the machines in use are "Corona" machines like those employed for treating sisal, but with certain alterations to adapt them to the different structure of the banana stalks. In countries such as East Africa, where similar machines are already available, it might be worth while conducting experiments to determine whether they can be adapted for treating the wild banana.

* *Bulletin of the Imperial Institute*, Vol. XXXVI, No. 1. pp. 69-71, 1938.

STORAGE INVESTIGATIONS WITH TRINIDAD AVOCADOS, 1938.

By C. W. Wardlaw.

(Low Temperature Research Station, Imperial College of Tropical Agriculture, Trinidad, B.W.I.)

I. Introduction.

Investigations on the cold storage of Trinidad avocados of seedling origin (except Pollock) undertaken in 1933 (3) and 1934 (4), showed that only a few of the large number of 'varieties' could be held at a temperature of 45°F. for 20-25 days without sustaining low temperature injury. Higher storage temperatures, *e.g.* 50°F., on the other hand, were found inapplicable because of the general tendency of fruits to ripen before the required storage life had been achieved. These general conclusions were subsequently confirmed in Jamaica (8). In brief, it has been ascertained that the striking range in variation exhibited in the matter of size, shape, colour, texture, &c., in West Indian avocados is closely paralleled by the range in physiological behaviour shown when fruits are subjected to refrigerated or gas storage, or to a combination of both. Thus, from the point of view of keeping quality, it is evident that West Indian avocados constitute a very mixed assemblage of types: in only a few are the necessary commercial qualities combined with adequate resistance to the cold storage temperatures required for overseas transport.

A sequel to these general findings is that, in extending orchard work on avocados with a view to creating an export industry, only those varieties possessing cold resistance in storage should be used for propagating purposes (5). As a result of the 1933-34 tests mentioned above, it was possible to indicate six useful varieties. Budwood from these several trees has been obtained by the local Department of Agriculture and grafted plants are now being raised, but so far no fruit has been available for cold storage trials. As the lots of fruit originally used were taken from adult, and sometimes very old trees, growing in particular localities, it cannot be predicted that young grafted plants, grown presumably under a variety of conditions, will yield fruit whose storage behaviour will be precisely that of the original tree, but a certain element of optimism may be entertained.

Just as it has been possible to effect a selection of useful varieties in Trinidad—a procedure which is by no means exhausted—so also in other West Indian islands a further selection of commercial types may be obtained; accordingly, the relevant investigational work should not be neglected in those Islands which are interested in this industry (5).

More recently, the conception of a wider utilisation of the avocado in the West Indies has included the possibility of securing types of the Guatemalan race whereby the fruiting period, instead of being confined almost entirely to the summer and autumn months as at present, might be extended through the spring and possibly early summer months (7). It is to be noted, however, that although it may be possible to raise the general standard of productiveness and quality by introducing and establishing improved types, it is not considered likely that any marked increase in the oil content of fruits will be effected, this character being largely determined by environmental factors.

At a time when questions of dietetics and local production of food supplies are commanding an increasing amount of attention, the very considerable value of the avocado as a source of concentrated nutriment may again be stressed (6).

II.—Effect of Season.

1938, a year of high rainfall in Trinidad, has been considered a poor year for avocados, fruits of known varieties tending to be of poorer flavour than usual. This has been ascribed to an increased wateriness of the pulp. The work of Stahl (2) in Florida has shown clearly that the water content of avocados is a factor which is subject to considerable fluctuation in relation to soil and climatic conditions, the variable water content of fruits being closely linked up with the oil content (percentage of fresh weight) and presumably with protoplasmic factors in general. Interest therefore attaches to the storage behaviour of fruit, produced under conditions of abnormally high rainfall, as in 1938, for comparison with records previously obtained from the same varieties.

III.—Description and Storage Trials of Varieties.

Five varieties of avocados picked full-grown, green, have been kept under observation, unwrapped and uncrated at the following temperatures and humidities: 40°F. and 78% R.H. 45°F. and 88% R.H. 53°F. and 85% R.H. and 60°F. and 87% R.H. Two of the varieties, *St. Joseph No. 2*, and *St. Joseph No. 3*, are among those previously selected in Trinidad as possessing the required cold resistance in storage. The Guatemalan type, *Panchoy*, and the Guatemalan-West Indian type, *Collinson*, both in the variety collection at the St. Augustine Nursery, and a fifth type not previously tested, which for convenience may be referred to here as *Tunapuna*, were also examined.

St. Joseph No. 2.

This variety is characterised by its long, semi-bottle-necked appearance, pale green skin on ripening, adherent stone, and good flavour and texture. In the trials conducted in 1934 (4), it was observed that fruit picked full grown but firm could be held at least 27 days at 40° or 45°F. without manifesting symptoms of chilling injury during subsequent ripening.

As judged by superficial examination on receipt, the fruit obtained for the tests reported here in no way showed the effect of the prevailing wet season. The following storage data were obtained.

(i) 15 days at 40°F., with subsequent ripening, during 6 days, at 60°F.: no chilling; condition and flavour excellent.

(ii) 21 days at 40°F.: first trace of pulp darkening, *i.e.* slight chilling injury; after 4-7 days ripening at 60°F.: chilling still very slight and flavour good; no fungal wastage.

(iii) 15 days at 45°F., with subsequent ripening, during 6 days, at 60°F.: no chilling; condition excellent; no fungal wastage.

(iv) 21 days at 45°F.: some fruits ripe, no chilling; no fungal wastage.

(v) 25 days at 45°F.: fruits becoming ripe; very slight chilling in some fruits, but flavour good; on ripening during 3 days at 60°F., a majority of fruits showed no chilling, while some showed a watery breakdown next the stone; no fungal wastage.

(vi) 16 days at 53°F. and 5 days at 68°F.: fruits ripe to over-ripe, and anthracnose spots (*Colletotrichum gloeosporioides*) developing.

(vii) 15 days at 60°F.: all fruits quite ripe; some anthracnose Spots.

These records confirm the previous finding that *St. Joseph No.* 2 ranks as a variety well suited to the special requirements of an export industry. By comparison with the records obtained in 1934 it will be noted that fruits showed a decrease in their resistance to chilling injury in storage at 40° and 45°F.

St. Joseph No. 3.

This variety, a seedling from the same parent stock as *St. Joseph No.* 2, may be described as conical purple, with adherent stone and of good quality; it is picked full-grown, green, and ripens to a deep purple.

Some considerable interest attaches to this variety. Early in the season the tree, which is old and cankered, had been heavily pruned. The crop was small and the writer's attention was directed to the fact that the fruits were watery in the sense that, on shaking, the movement of water could be detected within. In some, though not in all, considerable quantities of water were present between the endocarp and stone, a condition which was accompanied by abnormal ripening, involving a soggy breakdown of the inner pulp at tropical temperatures.

During the storage trials of 1934 (4) it was found that this variety could be kept for at least 28 days at 40° or 45°F. without sustaining low temperature injury. By contrast, the following records obtained during the current tests, with fruits picked full-grown but green, are of considerable interest.

(i) 15 days at 40°F.: incipient chilling; later, during ripening for 6 days at 60°F., very severe blackening of the pulp developed.

(ii) 15 days at 45°F.: fruits ripening, slightly purple, but chilled, the intensity of chilling injury increasing with the ripening of the fruit.

(iii) 15 days at 53°F., followed by ripening, during 6 days, at 60°F.: no chilling, full purple skin colour developed; flavour fairly good; no fungal wastage.

(iv) 15 days at 60°F.: fruits fully coloured, and ripe to over-ripe; no chilling or fungal wastage.

From these data, read in conjunction with those obtained in 1934, the interesting conclusion may be drawn that the water content of the fruit, in which many aspects of growth and cultural conditions are reflected, is in some way related to its susceptibility to chilling injury in storage. No data are available to indicate whether this hypothesis can be given a more general application, *i.e.* the greater resistance to low temperatures shown by Californian varieties in which the moisture content of fruits is low. The current observations on *St. Joseph No.* 3 also confirm an earlier finding that fruits are most subject to chilling during the ripening processes.

Panchoy.

This variety, an example of the Guatemalan type and recorded as growing in its natural environment at an elevation of 5,100 ft. was originally introduced into the U.S.A. from Antigua, Guatemala.

The fruit is described (1) as broadly obovoid, weighing 16-20 ozs., skin rough, green and very thick, seed rather small, fruiting from January to April in Guatemala, spring and summer in California, and December in Florida. Though its oil content is good, its marketability in the U.S.A. is stated to be poor on account of the hard shell.

Trees of this variety were introduced to Trinidad through the U.S. Department of Agriculture. When on the tree and during storage, the rough corrugated skin is so firm and hard that judgment of maturity is very difficult. The harvesting period in Trinidad, as judged by trees at the St. Augustine Nursery, occurs in the month of November, the Central American fruiting periodicity not being maintained.

In that *Panchoy* is a pure Guatemalan mountain type it was anticipated that it might exhibit considerable resistance to low temperature injury in storage.

The following observations were made during storage and ripening:

(i) 7-11 days at 40°F.: slight evidence of chilling in the development of a purplish coloration of the pulp; this was confirmed during subsequent ripening at 60°F.

(ii) at 45°F.: chilling suspected after an exposure of 7-11 days, and confirmed by the 15th day; on subsequent ripening at 60°F., slight chilling but flavour not noticeably altered.

(iii) at 45°F. for 21 days with ripening at 60°F: fairly severe chilling; failure of localised regions of the pulp to ripen.

(iv) at 53°F. for 16 days: no chilling; normal ripening on transference to 60°F.

Panchoy fruits developed a conspicuous external browning, the rugose skin being particularly susceptible to desiccation, possibly in conjunction with chilling. This variety is in no respect suitable for export. It is of interest that anticipations as to its resistance to chilling injury have not been realised, a further indication of the importance of edaphic factors on the constitution of avocado fruits.

Collinson.

This variety, described as a Guatemalan-West Indian hybrid was produced in Florida (1) and introduced into Trinidad through the U.S. Department of Agriculture. The fruit as grown in Trinidad is spherical to sub-spherical, with a smooth, dark green, waxy skin. In Florida, where fruits have an average weight of 20 ozs., the fruiting period is from November to January; in Trinidad, November to December probably covers the harvesting period. The following storage records were obtained.

(i) 21 days at 40°F.; with subsequent ripening, during 4-7 days, at 60°F.: no chilling.

(ii) 25 days at 45°F., with subsequent ripening at 60°F.: no chilling.

(iii) at 53°F. until ripe: no chilling.

From these data, it is evident that the *Collinson* can be added to the list of varieties which, as grown under Trinidad conditions, possess adequate cold resistance in storage. Fruit obtained during a rainy season, as in 1938, however, tends to be rather watery and lacking in flavour, but cultivation in dry localities might remedy this defect. During storage at 40°F., 45°F. and 53°F. a profuse anthracnose spotting appeared round the distal end of fruits, but showed no further development during ripening at 60°F. Fruits held at 60°F. throughout, on the other hand, developed severe anthracnose spots which spoilt their appearance, though the pulp was not penetrated. In some fruits the seed had germinated, the roots penetrating through the pulp to the skin.

Tunapuna.

This local seedling variety has not hitherto been tested in cold storage. It is of medium size, pear-shaped, with thick, yellowish pulp, is sweetish rather than 'nutty' in flavour, and possesses an adherent stone. The following records were obtained.

(i) 14 days at 40°F.: chill pitting on the skin but no internal symptoms; ripening at 60°F., accompanied by severe blackening of the pulp.

(ii) 14 days at 45°F.: slight chilling next stone; on subsequent ripening at 60°F., severe chilling; also severe anthracnose.

(iii) 10 days at 53°F.: majority of fruits ripe; no chilling.

Tunapuna thus illustrates what is characteristic of many Trinidad varieties, *i.e.* inability to withstand a temperature of 45°F. without chilling, and a tendency to speedy ripening at temperatures above 50°F., whereby overseas transport to distant markets would be precluded.

IV.—Conclusions.

1. Earlier findings on the keeping quality of a variety selected for cold resistance in storage have been confirmed; an additional suitable variety has been added to the list of those now being propagated for export.

2. A variety, previously selected for its high degree of cold resistance in storage, but observed during the current wet year to be characterised by an excessive wateriness, was found to be distinctly subject to chilling injury, indicating the importance of soil and climatic factors in this physiological relationship.

3. Contrary to expectation, a pure Guatemalan type grown in Trinidad was found to be very subject to chilling injury in storage.

4. A close relationship was again established between the onset of chilling injury and maturation processes.

5. Fungal wastage was slight, and was chiefly due to anthracnose spotting (*Colletotrichum gloeosporioides*).

The writer is much indebted to the Trinidad Department of Agriculture and to Mr. Lezama, St. Joseph, for supplies of fruit.

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THE CONTROL OF SCAB AND CERTAIN OTHER DISEASES AND PESTS OF GRAPEFRUIT BY FUNGICIDES AND INSECTICIDES.

By R. E. D. Baker.

Senior Lecturer in Mycology, Imperial College of Tropical Agriculture.

I.—Diseases and Pests.

Grapefruit is at present mostly grown in countries where the climate is sub-tropical, such as Florida, California, Palestine and South Africa. A much smaller amount is grown in the humid tropics, especially in Brazil, Jamaica, Trinidad and Puerto Rico. Under both types of climate it is subject to a number of pests and diseases which can be controlled by spraying, dusting or fumigation. Grapefruit is still largely sold on its appearance, good clean fruit commanding a better price than fruit with a damaged or discoloured rind, which indeed, is not usually worth exporting at all. Therefore, any spraying or dusting treatment which will improve the appearance of fruit is likely to be financially successful, and, in most countries where a high quality export fruit is produced, spraying is an essential routine practice carried out every year. In dry countries the control of scale insects is of major importance. Not only will they render fruit unsightly, but a severe infestation will damage and sometimes kill the trees. They are usually controlled by means of tent fumigation or by oil sprays. In the humid tropics scale insects are largely controlled by the naturally occurring entomogenous fungi, and unless these fungi have been killed by copper fungicides used in the control of fungus diseases, scale insects are not a major problem.

In Florida and Puerto Rico and recently in Trinidad the control of Scab Disease is of great importance. Rust-mites also occur regularly in these three countries, and in addition, Florida and Puerto Rico have to contend with melanose, a disease absent from Trinidad. In Trinidad scale insects usually only occur on trees exposed to the wind, or on trees which are growing poorly for other reasons.

Scab Disease, caused by the fungus *Sphaceloma fawcetti* has attacked grapefruit in Florida and Puerto Rico for many years. It has only recently become a problem on the Trinidad grapefruit. In Trinidad, and probably also in Florida and Puerto Rico, Scab Disease was present on sour oranges and rough lemons for some years before the grapefruit was attacked. Experiments have shown that the strain of the fungus attacking the grapefruit in Trinidad is different from that attacking the sour oranges and rough lemons. It is suggested that the 'grapefruit strain' has arisen as a mutation, and there is evidence to believe that similar mutations of this fungus have occurred elsewhere. The history of this disease is discussed by Jenkins (1). It probably originated in the Orient, and has been present since ancient times in Japan. It was probably introduced into Florida on the Satsuma orange in 1876 and was first recorded by Lamson-Scribner (2) in 1886. Since then it has spread throughout the citrus growing countries of the Western Hemisphere with the exception of California and Arizona where the climate is probably unsuitable for its development.

Sphaceloma fawcetti can only attack young tissues, which are stimulated to corky proliferation so that the resultant damage is permanent. In old lesions the organism may be dead, but the corky tissue produced in response to its attack persists and is a serious cause of blemishes on fruit. Both leaves and fruits are affected, the latter according to Winston (3) becoming immune to the disease when they are three-quarters of an inch in diameter. Leaf infection, unless it is exceptionally severe, when it may interfere with the normal growth of the tree, is unimportant except in so far as it constitutes a reservoir of spores which may later infect the young fruit. Fruit remains in a susceptible condition for a period of six to eight weeks after it is set, and conditions suitable for infection are almost certain to occur at this time. It is therefore of paramount importance that the fruit should be coated with a protective spray as soon as possible after setting. Florida experience indicates that to obtain satisfactory control of this disease all fruit should be sprayed within ten days of setting. Spraying equipment for the control of Scab Disease must therefore be large enough to cover the whole orchard in a maximum of ten days, and such equipment will be more than adequate for the control of all other diseases and pests controllable by spraying, should this be required.

In any spraying operation the cost of the chemicals is the heaviest item. Although more difficult to make up than many proprietary fungicides, Bordeaux mixture is cheap and compares favourably with the majority of them as regards initial cost. A weak Bordeaux mixture, 3-3-50, is commonly used for scab control. Bordeaux of any strength has, however, certain disadvantages which are probably shared by all efficient copper fungicides. Their chief disadvantage is that they kill the entomogenous fungi which in Florida, Puerto Rico and Trinidad constitute an important natural control of scale insects. This is partially got over in Florida by incorporating into the Bordeaux mixture an oil emulsion which will kill scale insects; but even after using Bordeaux-oil a further oil spray seven or eight weeks later is sometimes necessary for scale control.

In areas where Scab Disease is severe the use of Bordeaux mixture or some other efficient copper fungicide, possibly several times a year, is essential for its control. It is well known, however, that the disease is only serious under wet conditions, and in the drier areas a weaker fungicide, such as lime sulphur, which will not damage the entomogenous fungi so seriously, is sufficient. Lime

sulphur is an excellent spray for grapefruit and is commonly used. In addition to controlling a mild attack of Scab, it will give a good control of rust-mites, keep down scale insects by killing the crawlers, and will keep down melanose.

Melanose, caused by *Phomopsis citri*, which is also one of the fungi causing stem-end rots of citrus fruit, is common and serious in Florida, rare and of little account in Puerto Rico and absent from Trinidad. *Phomopsis citri* is present in Trinidad and occasional cases of Phomopsis stem-end rot are found (the common cause of stem-end rot there is *Botryodiplodia theobromae*). It is probable that local conditions, possibly a too high temperature, do not allow of the development of melanose symptoms. This disease is controlled by any spray which will control Scab Disease.

Damage to fruit known as 'russeting,' 'silver skin' or 'shark skin,' caused by the citrus rust-mite *Phyllocopterus oleivorus* is common in Florida and Puerto Rico, and is second only to scab in causing the rejection of fruit for export in the packing houses. In Trinidad it is still the main reason for rejection of fruit, although Scab Disease, unless controlled, may soon pass it. It must be remembered, however, that as in the case of scab and melanose, fruit damaged by rust-mites is not a total loss, being unaffected internally and quite suitable for canning or for the preparation of juice.

It is well known that sulphur usually gives an excellent control of mites, and a lime sulphur spray has been found to give excellent results in the control of citrus rust-mites, in addition to assisting in the control of the other pests and diseases already discussed.

At least six scale insects:—red scale, mussel scale, long scale, green scale, purple scale, snow scale, &c., attack grapefruit, usually on leaves and branches, but sometimes on the fruit. In the humid tropics they are largely kept down by entomogenous fungi on healthy unsprayed trees. Trees which have been sprayed with copper fungicides or are exposed to the wind or are unhealthy for other reasons, or at the end of a long dry period, may be severely attacked and need spraying. Oil emulsions are commonly used, either in combination with Bordeaux mixture or separately, some growers favouring the one, some the other.

II.—Sprays.

To obtain the best results, Bordeaux mixture should be freshly prepared, using good quicklime. Poor, gritty quick lime will clog and damage spraying machinery, and if sprayed at a sufficiently high pressure will damage the skin of young fruit. Owing to the difficulties inherent in obtaining and storing good quicklime, and in mixing the Bordeaux itself, many proprietary Bordeaux substitutes and other copper fungicides have been put on the market. If properly prepared, Bordeaux mixture is an excellent cheap protective fungicide and adheres well to foliage and fruit. Any proprietary copper fungicide or Bordeaux substitute, although cheaper and much easier to prepare than Bordeaux mixture, should be thoroughly tested, both for fungicidal and adhesive qualities, on an experimental scale before being used on a commercial scale in place of Bordeaux mixture.

Lime sulphur of known specific gravity is best purchased in drums from any reliable firm of spray manufacturers. If economy is essential and time and discomfort of little object it may be made on the spot. The mixture of lime and sulphur requires prolonged heating in an iron vessel, a most unpleasant task in a hot climate, and it is difficult always to prepare the same strength of stock solution. Oil emulsions may also be purchased in drums but are not so difficult to make on the spot, using a spraying machine for emulsifying the oil.

Care must be taken in the correct preparation of all these sprays if severe burning of young foliage is to be avoided. Bordeaux mixture must be alkaline, lime sulphur must be correctly diluted according to the makers' instructions or the specific gravity of the stock solution, and oil sprays must be properly emulsified. Finally because of their action on metals, lime sulphur should not be used in copper or brass and Bordeaux mixture in iron tanks or machinery.

Typical spraying programmes used for the control of grapefruit diseases and pests where scab is of paramount importance and melanose and rust-mites secondary considerations are as follows:—

I. To control severe scab and melanose in Florida: [Rhoads and de Busk, 1931 (4).]

Two applications of Bordeaux-oil emulsion (3-3-50 Bordeaux plus 1 per cent. oil) are used, the first just before growth starts in Spring, the second during the last of the bloom, when at least two-thirds of the petals have fallen.

II. Where scab is not so severe and melanose is unimportant, but where the control of rust-mites is desirable: [Rhoads and de Busk, 1931 (4), in Florida.] Two applications of lime sulphur are necessary, the first just before the Spring growth starts, the second later.

In Florida a combined copper-sulphur spray is sometimes made by adding wettable sulphur to Bordeaux mixture. Such a spray should control both scab and rust-mites and is worth a trial in Trinidad. The strength recommended is 4 or 5 lbs. to every 50 gallons of spray.

In Puerto Rico where there is no winter and but little check to growth all the year round (conditions similar to Trinidad) the following spray programmes were used:—

III. To control severe scab, slight melanose, and severe rust-mite injury.

Five sprays as follows:—

1. Lime sulphur or Bordeaux before blossom appears.
2. Bordeaux as the petals fall.
3. Lime sulphur to control rust-mites.
4. Oil emulsion to control scale insects.
5. Lime sulphur to continue control of rust-mites, scab, melanose and scale crawlers.

It is probable that money could be saved by replacing these five sprays by two or three combined sprays, using Bordeaux-oil, or Bordeaux-wettable sulphur.

IV. To control slight scab and severe rust-mite injury.

1. Lime sulphur before blossom appears.
2. Lime sulphur as the petals fall.
3. Lime sulphur about six weeks later.

Sprays 1 or 3 but not both, may be omitted, depending on the season and on the severity of the parasites.

In Trinidad where there is no melanose, but where rust-mites are already severe in certain areas and scab is likely to become serious, the following possible programmes are tentatively suggested.

V. For areas where scab is serious and rust-mites also occur.

Three sprays per annum as follows :—

1. Lime sulphur or Bordeaux mixture before blossom appears.
2. Bordeaux-oil or Bordeaux-wettable sulphur as the petals fall.
3. Lime sulphur or oil emulsion later, depending on circumstances.

VI. Where scab is slight, but rust-mites occur.

Two sprays per annum as follows :—

1. Lime sulphur as the petals fall.
2. Lime sulphur or oil emulsion later.

There is always the risk to be remembered that once spraying with fungicides is started, one or more oil emulsion sprays per annum may have to be added to control scale insects. It is hoped that it will be possible shortly to carry out spraying experiments on a variety of proprietary fungicides with a view to finding a satisfactory substitute for Bordeaux mixture for use under Trinidad conditions.

III.—Spraying Machinery.

There are many possible types of machinery which could be used for a problem of this kind. An essential quality for spraying machinery to be used in the control of Scab Disease is reliability. The spray must be applied quickly and at the right time, and a serious breakdown of the machinery may lead to the ruination of the year's crop. Growers depending on one machine are therefore urged to keep an adequate stock of spare parts, to overhaul the machine regularly and keep it in good running order. The most important point is that the work must be done quickly, and an outfit capable of covering the estate easily in ten days is required. The selection of the most economical type of machine depends on local conditions, especially on the topography of the land, the lay-out of the orchards, and the methods of cultivation employed.

Spraying machinery can be roughly divided into two types—stationary and mobile. In the stationary type the spray pump, engine and mixing tanks are installed at a convenient central point, and spray is led by underground or overground pipes to all parts of the orchard. Stop-cocks to which hoses can be attached are provided at intervals so that every tree in the orchard can be easily reached. The capital cost of such a lay-out is very high, but once installed it is cheap to use and reliable. It is probably uneconomic unless at least five or six sprays per annum are contemplated, and is more suited to apple growing than to citrus culture. A modification of this type, the semi-portable machine, is often used in apple orchards. Here the machine can be moved from place to place along the roads in the orchard, and is supplied with a sufficient length of pipe-line to cover five or more acres without being moved. The engine, spray pump and mixing tanks are mounted on wheels and can be moved by a tractor or by animals when necessary. The capital outlay is less than that required for the stationary machinery, but is higher than that required for mobile machines. A disadvantage of this machine is the time wasted in taking up and moving the pipe-line.

Mobile machines can be obtained in all sizes from small, hand-operated machines to large tractor-drawn power units. Hand-operated machines are not used in the control of Scab Disease in Florida or Puerto Rico as, in level orchards where intercultivation is a routine practice, spraying with large mobile power outfits is simpler and cheaper. In rough or hilly country, however, the use of heavy power machinery is impracticable, and the small hand-operated machines are the only possible type. Such machines are used with considerable success in other tropical countries for spraying tea and coffee. In many Trinidad grapefruit orchards which have steep slopes, deep drains or heavily round-ridged beds the use of power machines will be impossible, and hand spraying will be the only possible method.

There are many types of hand-operated spraying machines, including knapsacks, stirrup-pumps, bucket pumps, barrel pumps and larger manual pumps operated by two or more men.

Knapsack machines of all types are generally unsuitable for orchard work in rough country in the tropics. They are too difficult to fill, too heavy when full, have insufficient pressure, and are too much of a handicap to the men working them to be a success. The best machines for this kind of work are those in which one or two men work a pump taking spray mixture from a four gallon oil tin, half barrel, oil drum or other container, while another man does the spraying with a gun or lance at the end of a fairly long hose. The disadvantages of hand machines for spraying grapefruit against scab are firstly, that to cover a large orchard in ten days or less a large number of machines and a large labour gang will be required; and secondly, that because these machines will be scattered through the orchard, any difficulties of water supply or spray mixing will be intensified. Advantages of this system over the large power outfits are that the capital cost of machinery is very small and that the risk of work being seriously held up by breakdown of machinery, a very real risk when the whole orchard depends on

one machine, is practically eliminated. If the difficulties can be overcome, it should be possible to spray grapefruit orchards on rough ground economically by this method, though the cost per tree is likely to be higher than that for spraying trees on flat land with power machines.

Mobile power machines of all sizes are available. In Florida, Puerto Rico, and in countries where citrus is grown under irrigation, the majority of the fields are level, there are no surface drains and it is possible to drive motor trucks and tractors through the fields in between the rows of trees. Large power machines which will cover a big acreage daily can therefore be used. In Florida both trucks and tractors are employed. With trucks, the spray pump, engine, and mixing tanks are mounted at the back and two men with spray guns ride alongside the machine. The outfit is driven slowly down between the rows and the trees are sprayed from both sides. With a tractor a different type of spray pump without an engine but driven by a shaft from the tractor, is employed. Both tractor and spray pump may be mounted on pneumatic tyres or caterpillar tracks. The procedure with a tractor is either the same as with a motor truck, or the men spraying walk alongside, passing rapidly round the trees, in which case the machine can miss a row on the return trip and only has to travel half the distance in the orchard. If there is a convenient water supply these machines will cover up to twenty-five or thirty acres each in an eight-hour day. If longer hours or even night spraying was possible very much more could be covered. Such machines work at pressures up to 600 lbs. per square inch, have a 30 or 35 H.P. engine, and may deliver 60 gallons of spray per minute from a tank of at least 400 gallons capacity. Because of their mobility they are not so dependent on a convenient water supply, but can if necessary be driven out of the orchard to the water for refilling without any serious loss of time. All sprays are mixed directly into the tanks, the agitators being kept running during mixing. They use a very large quantity of spray, anything up to 20 or 30 gallons being used on a large tree.

In Puerto Rico, where the fields are again mostly level and intercultivation is practised, somewhat smaller machines with 6 or 8 H.P. engines, 250 gallon tanks, 300-400 lbs. pressure and two spray guns are used. These machines can be drawn through level fields by two oxen which are led by a boy. Two men run the engine, mix the spray and do the spraying. With fifty foot hoses one row on each side of the machine can be sprayed, and four trees are sprayed each time the machine is moved. Oxen are very suitable for moving a machine of this type, as, although they move slowly, they can exert a considerable effort for a short pull, which is what is required.

It is very doubtful if large machines of the Florida type would be a success under Trinidad conditions. The fields are rougher than those of Puerto Rico and contain surface drains, some in addition being round-ridged. The type of machine used in Puerto Rico might succeed on level ground, or a lighter machine with a 3 or 4 H.P. engine and a 100 gallon tank might prove to be superior. Such information can only be obtained by trial and error, and it is hoped that information of considerable value will be obtained shortly.

IV.—Dusting.

Little or no dusting of grapefruit is done at present and only the scantiest information is available. The obvious advantages of dusting over spraying are that the machines are much lighter, and therefore more easily moved over rough ground, and that a large area can be covered quickly with quite a small and cheap machine. Disadvantages are that some dusts are hygroscopic in a humid climate; as a rule dusts do not adhere to foliage or fruit as efficiently as sprays; dusting machines use more chemicals per acre than spraying machines; and the hours per day when dust can be applied are strictly limited by wind and by the fact that dust only adheres satisfactorily to moist foliage. In spite of these disadvantages it is desirable that, in testing different types of machines and chemicals for the control of Scab Disease, dusting should be thoroughly tried.

Finally it must be emphasised that although scab is a serious disease of grapefruit, its control is possible, as can be judged from the experience of Florida and Puerto Rico grapefruit growers who have controlled the disease successfully and economically for many years. If spraying is seriously undertaken in Trinidad the industry will benefit indirectly from the control of other pests and diseases, notably rust-mites, which at present do considerable damage.

V. References.

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RAYON FROM BAGASSE.

The Victorias Milling Co., Philippines (according to a note in *International Sugar Journal*, 1938, p. 386), has worked out a satisfactory process for the manufacture from bagasse, of cellulose suitable for the preparation of artificial silk (rayon). This achievement, if followed up, should furnish an increasing demand for bagasse and so raise the value of one of the important by-products of the cane sugar industry.

FURTHER STUDIES IN TROPICAL LAND TENURE.

By H. M. Leake.

(*Continued from Tropical Agriculture*, Vol. XVI, No. 1, p. 14.)

IX. SUMMARY.

The preceding articles are designed to trace the steps taken in the various territories considered, for the more rigid definition of the relations between the land and the people. There has been, however, a further motive. The ultimate objective, the justification of the administrative control by the more advanced, over the backward peoples, is commonly, and justly, claimed to be the advancement of the latter, the provision of an ever widening field for the development of their innate potentialities. As a statement of the objective it is unexceptionable; in the interpretation of that statement in practice lurk several dangers.

To those high up on the ladder of civilization, such advancement visualizes evolution to the stage of peoples capable of standing by themselves. Following the natural sequence of thought and experience, these place political aspirations in the forefront and, as a means to that end, education. It is very doubtful, however, whether this approach to the problem is sound. It is true that political independence requires a standard of intelligence among a large element of the community which can only be acquired by education; but education is a two-edged weapon. It creates in the educated desires which, unless the means for satisfying them are to hand, can only breed discontent. Any one who has lived among such races, has sympathy for their aspirations and learned to appreciate the capabilities latent in most, is inevitably compelled to desire the development of those capacities and to advocate education as the readiest means of achieving that end. But if it is sometimes necessary to be cruel to be kind, kindness is not infrequently a disguised form of cruelty; and education carried beyond the stage where it lies within the means of the educated to satisfy the desires thereby created, constitutes such a kindness. One can applaud the heart but hardly the head of those who advocate uncontrolled education. The primary pre-requisite to advancement, therefore, is a material development which will assure to all the means of satisfying those desires which, according to their several standards of education, may justly be termed necessities. At the lowest end of the scale the word 'necessities' is synonymous with the word 'essentials'. The view here expressed is that it is a false kindness to thrust education on the children of the wild who live contented in an environment than which they know no other. Contentment each in his degree, and not a standard of life determined on a basis of preconceived ideals should be the primary objective. This is not incompatible with the stated aim; it is a definition of the road to that goal rather than of the goal itself. Here, as Aldous Huxley says of human effort generally, about the ideal goal there exists and has existed a very general agreement; not so with regard to the roads which lead to that goal.

It is for the reasons briefly outlined above that the view adopted here is that the material basis of prosperity requires to be first assured. There is a growing body of evidence to show that, in many of the territories considered, the mass of the population who are living on a diet below the minimum, is very considerable. That there is truth in the statement that man cannot live by bread alone is undoubted; but equally certain is it that man cannot live without bread and, in this modern world, the word 'bread' has to be extended to include all those essentials which alone will satisfy the developed and developing mind.

This material aspect has not, in the past, received the attention it deserves. But there is a reason for this. The systems under which production was carried on were evolved at a time when demand was capable of absorbing all the produce offered. By the opening up of communications, demand and supply were brought into contact and, in most countries, material wealth increased rapidly. It was these resources which directly, and indirectly through the security they offered for loans, rendered possible large capital works, railways and roads, throwing open ever larger areas of supply. On the one hand, the means of meeting the growing individual needs of a population subjected to an intensive form of education appeared to be within such easy reach that the major danger seemed to be that wise spending would not be learned in time; on the other, the belief appeared well founded that in this growing wealth lay a permanent fund for meeting the expanding cost of Government. (It might, perhaps, define the position better if the latter attitude were termed an assumption rather than a belief; there is an element of positive thought about the word 'belief' which was non-existent.) Nowhere is this assumption seen more clearly than in India where the revenue is largely derived from the land. Throughout the long period from the earliest accession of British Dominion over India to the war, the periodic settlements of land revenue showed an almost unbroken increase of land revenue of a magnitude sufficient not only to meet the growing needs of Government but to permit reduction in the rate of assessment.

In post-war years this complacency has received a rude shock; the assumption of a steadily increasing source of wealth has been proved to be ill-founded. Nor is the war the only cause. It is no part of the present argument to discuss whether the war has been the main or a secondary cause of the changed conditions. The war has, no doubt, precipitated matters and has, thereby, intensified the economic strain; but other factors were moving to produce the same end. These were the approaching market saturation resulting from the too rapid opening up of new territories to productive enterprise and the adjustment of local,

to world prices which resulted from the development of free communications, the latter again well exemplified by India. The potentialities of this latter factor have a clearly defined limit, the point when adjustment becomes complete; those of the former could have been, but were not, the subject of control. The complacency which accepted as axiomatic a steadily increasing wealth sufficient both to meet the expansion of Government expenditure and to provide a higher standard of living to the individual, has gone. A new orientation is required which recognises, as industry has had to recognise, that though the general trend may be progressive, that progress is by a series of alternating advances and recessions.

The basic fact about the territories here considered is that their primary source of wealth is agricultural. In some, it is true, minerals and oil form a not inconsiderable asset, but these, though they may add considerably to the communal wealth through export taxes and may, in consequence, indirectly benefit the mass of the peoples by relieving them of taxation they might otherwise have to bear, have little direct influence on the majority since only a small percentage of the population is directly engaged in these industries. Even where mining forms a major industry, it remains true that the income of the mass of the population is derived from agriculture.

Within agriculture, again, the two branches have a very different importance; crop production in all cases vastly exceeds the raising of stock and it will not be misleading to say that the prosperity of these territories is directly dependent on crop production. That statement, however, requires amplification. Crops are grown for a dual purpose. The primary function is to provide the basic need of the resident population; more particularly in these tropical climates, food. The secondary function is to provide the means for purchasing those additional requirements which the individual cannot produce himself, and which the advance in the standard of living makes ever more numerous. Except in the most backward communities, these additional requirements surpass in importance, if not in value, the basic requirements for food, and the raising of exchange cultures takes pride of place in the economy of the country.

The first stage in this development arises within the community itself. Each unit of the community, the village, is self-supporting but within it, a division of labour establishes a certain craftsman element which may not cultivate directly but earns its sustenance by its labour for the community and is commonly remunerated in kind. The second stage results from the birth of urban conditions with a large population dissociated from the land and deriving sustenance from the excess produce of the surrounding country. Here the transactions are indirect and payments come to be made in cash. Lastly, and dominating the situation in recent years in most of the territories, is the third stage, production for an export market.

It is important here to realise that the dominance of this third stage is inevitable and essential if the standard of living is to be materially raised. The ultimate goal, it may be repeated, is a community able to stand by itself and long before that stage is reached a demand for goods, the product of the industrialised countries, which cannot be produced locally, will not only have arisen but must be satisfied, for, without such satisfaction progress would be impossible. The necessary corollary to imported goods is an export of such produce as the particular country may be capable of raising. Progress, thus, inevitably involves a breakdown of isolation; the territory becomes economically part of the larger world and subjected to the economic disturbances which may occur therein.

Most of the territories here dealt with have already proceeded far along this road. Some, indeed, have proceeded so far that they have become exposed to a new danger. The raising of exchange cultures has proved in times past so profitable that the production of the primary essentials has been neglected. The food crops are no longer adequate to meet the needs of the population and even the small cultivator secures part of his food supply by purchase. Mauritius, Fiji and the West Indies among the British possessions illustrate this position in varied degree and the same is true of Hawaii. It is a precarious position. In times of depression, the country which can feed itself can always draw into its shell to re-emerge as a producer for export when times improve. The experience of doing without luxuries which have come to be considered essentials may be unpleasant but bears no comparison with that of a country incapable of raising its own food supply. Two problems are thus presented; the problem of maintaining an adequate internally raised food supply and the problem of raising exchange cultures.

The former of these two problems is not the simple matter it might be supposed. Recent investigations suggest that even the customary diet of many of these peoples is inadequate and that inadequacy finds its expression, if not in diagnosable disease, in a general mental and physical inertia which constitutes one of the most formidable obstacles to progress. The earlier conception of the primary function of Government, that of assuring the food supply of the peoples, against natural calamities such as famine, the organization for which is seen in the highly developed famine relief system of India, no longer satisfies the requirements. In many cases the far harder task of raising the customary, to an adequate diet has to be undertaken. This subject with its rapidly growing volume of literature cannot be more than mentioned here; a discussion is to be found in the Colonial Problem.* It may merely be pointed out that the task becomes particularly hard where the pressure to supply the export market had led to encroachment on production for the home.

With regard to the second problem, it is hardly necessary to repeat here what has already been stated in the introduction to these studies. Put briefly, the basic fact is that the large extensions of area brought under cultivation in recent years

* Institute of International Affairs, 1937.

has created a position, if only a temporary one, when supply has outrun demand. It is the fact that is here of importance and it is immaterial to the producing country whether the position is rendered more critical by a contraction of demand. It is no longer sufficient to raise produce; it is the purchaser and not the producer who, under these conditions, calls the tune; and the producer not only purchases as cheaply as possible but purchases selectively. Quality assumes an importance never before possessed by it; the country which does not aim at high quality in, or standardization of its exportable produce, will suffer in the highly competitive markets of the present day and even find itself excluded therefrom.

This is a new aspect, hardly apparent when the basic principles of colonial development were laid down. At that time the primary question was one of producing in quantity sufficient to satisfy the rapidly increasing demand. Methods were advocated which would lead speedily to increased supplies and little attention was paid to quality. This motive is to be traced from the earliest days of Colonial expansion in the West Indies and is carried down to the early years of the present century in, for instance, Kenya and, outside the British Empire in the Congo. It was a method of European control under which, particularly in the early days, little regard was paid to the rights of the local populations especially in the matter of land, for land supplied the security which proved the attraction. The movement led to the development of estates held by individuals or companies and worked by, first slave, and later wage labour.

Coincident with, but largely independent of the change in relative importance between quantity and quality, the conscience of the dominant races began to be stirred. The question arose whether the native interests were being sufficiently regarded. This question has been answered in no unhesitating manner; the native interests are now recognized as dominant. In West Africa, owing to its late occupation, the newer policy was free to be developed without awkward questions of prior commitments and its adoption has resulted in a system in which the maintenance of all reasonable native customs is the dominant consideration and which, in practice, takes the form of small peasant holdings. The fundamental question in all these is the suitability of the various systems, found now in infinite variety and admixture, to provide that quality which has been shown to be the dominant consideration if exports are to be maintained.

In the above evolution of ideas it is the human element that has been stressed and it is from the human aspect that the problem is still mainly discussed. This is peculiarly true of the Carter Commission (Kenya Land Commission) on Kenya, which has been considered in the article on that Colony; it is true also of the recent reports on Trinidad and Mauritius and it is true of the series of addresses given at the recent Summer School on Colonial Administration* though recognition of the point is to be found in Miss M. Perham's recent account of native administration in Nigeria.† This failure to recognize the full implications of the fundamental changes of recent years is not surprising; the subject is very technical and those responsible for laying down the lines of policy are not usually well equipped with such knowledge. It may be well, therefore, to give a brief explanation of the technical points involved.

In all agricultural production there are two organisms concerned, man the producer and the crop or animal, the produced. Since, however, stock play only a relatively small part in the scheme of tropical development, the argument may, for simplicity, be confined to man and the crop. The range of conditions under which any particular crop plant will grow may be very wide, but if economic production is to be attained, this range is markedly reduced. Of the two organisms concerned, man is undoubtedly the more adaptable. His function as an agriculturist is so to adapt the local conditions of growth that they will fall within the range covering economic production: this is, in fact, the most comprehensive definition of the practice of agriculture excluding the work of the plant breeder which consists very largely of adapting the plant to particular environments. It is the crop and not man which sets the limits. To argue from the human aspect, therefore, is comparable to the process of adapting facts to fit theory and the only sound approach to the subject is from the facts of the plant's requirements. The history of tropical agriculture is redolent of the failures resulting from failure to recognise this fact. The problem becomes enormously complicated when quality is the dominating factor in determining the value of the produce. The preparatory processes to which the produce of the more valuable tropical crops have to be subjected if quality is to be obtained are, in various degrees, technically intricate and may involve considerable outlay of capital. A system of human organisation which does not make provision for these, must be unsound. Such a system may be compared to an attempt to build a house without the straw, in modern phrase the kiln, with which to prepare the bricks.

The point has not entirely escaped attention. In the increase of the technical staffs of the various Departments of Agriculture, in the large volume of legislation bearing on agricultural matters as reviewed in the articles preceding this summary, there is ample evidence of the realization of the need for a better control over production, a control which will lead to a greater assurance of quality. But these measures partake of the

* Oxford Univ. Summer School on Colonial Administration, 2nd Session, 1938.

† Native Administration in Nigeria; M. Perham, 1937.

nature of and, in fact, are after-thoughts, graftings onto an accepted system which is held to be sacrosanct. Within the limits so defined, the technical departments have devoted much zeal and energy in attempts to secure quality. But, if the administrative outlook has been concentrated on the human aspect to the neglect of the technical, the technical outlook has reversed the order and concentrated on the technical aspect to the neglect of the human. The need for regulation in all stages of raising the crop and processing the product has been fully recognized by the technical service and, in the absence of other agency, it has set about such regulation. The Agricultural Departments, fortified by legislation, are rapidly absorbing wide administrative functions. It is possible to admire the zeal displayed in this and there are certainly no grounds for criticism, for these Departments have adopted the only method, within the policy laid down, which is open to them to achieve the objective with which they have been entrusted, quality. But, in doing so, they have been forced to serve a function for which they are ill qualified and the price is too heavy for it can only defeat the desired end, the evolution of the peoples to a stage when they can stand by themselves. The logical outcome is a vast bureaucracy with the accompanying vested interests penetrating and controlling the economic life of the country, the very antithesis of individual freedom. But such a logical outcome is not likely to eventuate, for it contains the seeds of its own destruction. Signs of this are already apparent. The process has, perhaps, been carried furthest in Uganda, particularly in the control of cotton, and in Zanzibar, in the control of cloves among other produce. In both, and particularly in the latter, disturbances have occurred which were the not unnatural reaction of a people harrassed by legislation which they do not understand, which they fail to realise is designed for their good, and which appears to them only as arbitrary restrictions on their liberty of action. It is hardly fair, as was done in Zanzibar, to place the responsibility for the disturbances on the Department of Agriculture for it was the system which had placed the Department in a false position, that was to blame. The only matter for surprise in all this is that the technical services have accepted the position willingly.

It is true that devolution has been attempted in most territories and that by the development of co-operation many of the defects inherent in direct administrative control of production by the Department of Agriculture are avoided. A further point in its favour is that co-operative production for export has, for obvious reasons, proved simpler than co-operative production for the local market: and all the large co-operative produce organisations have this in common that they supply an export market. Nevertheless, it is difficult to see how the required technical control and capital are to arise within a co-operative industry. For the present these must be supplied from without and the movement will be for long under the tutelage of officialdom. It will require more than commonly skilful handling if it is to shake off those official trammels and develop into a sturdy, self-reliant plant. Co-operation in most of the territories is in its infancy and has yet to be tried. The experience of India has been described. Though longest established and reaching large proportions, it is mainly a credit movement. This experience during the years of depression does not give any strong grounds for optimism. Indian co-operation has a long way to go before it attains financial stability and independence and before it becomes a dominant influence in the evolution of that country. It is very, perhaps more than, questionable whether time will be adequate in this rapidly moving world.

Associated with the co-operative movement are those measures which have been adopted, more particularly in the West Indies, to meet the needs of labour thrown out of employment through the depression; the land settlement schemes. Of these it may be said that they form a reasonable, perhaps the only, means of meeting the immediate situation. If English experience be a guide, however, these can never pay back the cost of development which must be borne by the community, a valid criticism only when they are conceived as more than emergency measures. As independent units, they can only provide the essentials for subsistence, and though this is preferable to unemployment, any return of prosperity leading to higher wages will pass them by with a general exodus as the consequence. To find a permanent niche in the social organization such settlements must raise exchange cultures in addition to maintenance and truck crops and be affiliated to some central organization capable of handling the produce so raised.

(*To be concluded.*)

PRICE OF FIJI CANE.

One of our correspondents points out that in Dr. Leake's article on "Further Studies in Tropical Land Tenure" which was published in our January 1939 issue no reference is made to the relation between Fiji currency and sterling. As there is a possibility of misinterpretation in making a comparison between the prices paid for farmers' canes in Fiji and elsewhere he desires to draw attention to the fact that the Fiji pound is linked to sterling on the basis of £111 Fiji to £100 sterling. The average price of 14*s.* 3*d.* (Fiji currency) paid in 1935 is, therefore, equivalent to 12*s.* 10*d.* sterling. He also thinks it desirable to make clear that cane in Fiji is purchased on the basis of sugar content, and that the basic price is varied upwards or downwards in accordance with the 'obtainable cane sugar'. The point raised is not perhaps of vital importance in relation to land tenure but it certainly is from the point of view of the returns obtained by cane farmers.—EDITOR.

AN APPRECIATION.—MR. G. A. JONES, C.M.G.

The transfer of Mr. G. A. Jones to Jamaica as Director of Agriculture affords a convenient opportunity for reviewing his career. As a member of the ubiquitous, notorious and innumerable clan, Gwilym Arthur Jones bears no deception in his name, for he was born in Wales in 1887. He was educated at Bangor University where he took the Diploma in Agriculture with first class honours. He came to the West Indies in 1908 as an Assistant on a sugar estate in Antigua, but his official career began in 1909 when he was appointed Science Master at the Antigua Grammar School. Later in the same year he was elected to the post of Assistant Curator in the Agricultural Department, Dominica, an appointment which he held until 1917 when he presented himself for special Government service in the United Kingdom. In 1919 he returned to the West Indies as Agronomist and Cane Farmers' Superintendent to the Ste. Madeleine Sugar Company Ltd. in Trinidad. He remained with this Company for ten years and in July 1929 joined the staff of the Agricultural Advisory Department of the Imperial College of Tropical Agriculture as Assistant Commissioner of Agriculture. On the retirement of Professor Ballou in 1933, Mr. Jones was promoted to be Commissioner of Agriculture.

Mr. Jones' early period of service in the Leeward Islands, the intimate knowledge he gained of the people and of the conditions under which they live, and the acquaintances and friends which he then made, proved to be of immense value to him when he returned to visit the Islands as a member of the Agricultural Advisory Department of the College. Mr. Jones' period of service with the Ste. Madeleine Sugar Co. Ltd. brought him into the closest contact with both plantation and peasant sugar-cane agriculture, and more especially with the co-operative movement among cane farmers, the establishment and success of which may chiefly be attributed to his untiring efforts. While in the service of the Ste. Madeleine Sugar Co. Mr. Jones became a member of the Board of Agriculture of Trinidad, of the Froghopper Investigation Committee, and of the Government Cane Farming Standing Committee. In 1927, he was selected to represent Trinidad at the Imperial Agricultural Conference held in London.

Mr. Jones brought with him to the Agricultural Advisory Department of the College in 1929 the valuable experience of twenty years' service in the West Indies. The College at that time had recently undertaken the functions which the Imperial Department of Agriculture had previously performed in the Windward and Leeward Islands. Mr. Jones immediately set about to reorganise the Agricultural Departments in the Islands and to enlarge their scope; the agricultural progress and development which have been achieved in recent years are a direct outcome of his initiative and active guidance during his tenure of office as Assistant Commissioner and later as Commissioner of Agriculture. The staffs of the Island Agricultural Departments were first reorganised and wherever possible increased; this was followed in 1931 by the appointment of a Marketing Officer during whose term of service the export trade of fruit and vegetables was organised and co-ordinated. In 1933, local committees were established to promote scientific investigations of sugar-cane agriculture in St. Kitts and Antigua. Among other important investigational work fostered by Mr. Jones may be mentioned the schemes designed to discover economic means for controlling cotton and citrus pests. Mr. Jones was always a keen advocate of land settlement and of the development of peasant agriculture, and in recent years he has taken a leading part in the launching of five-year development schemes in Antigua and the Virgin Islands designed to improve the status of peasant agriculture. Perhaps Mr. Jones' most important achievement during his period of service in the Advisory Department of the College was the success which attended his efforts to bring about co-operation among producers within and between the Islands. The co-operative movement has been most prominently exemplified by the West Indian Sea Island Cotton Association of which Mr. Jones was the first President. In the fruit and vegetable industry, successful co-operation was achieved in the formation of the Eastern Group of the West Indian Fruit and Vegetable Council, of which he was also first President. He also took an active interest in the affairs of the West Indian Lime Oil Sales Company, a co-operative organization for the marketing of lime-oil, and his wise counsel in this respect has done much to save an important West Indian industry. Other co-operative organizations between the Islands which have reached maturity in Mr. Jones' time are the Central Sugar Cane Breeding Station in Barbados and the local Banana Associations in Dominica, St. Lucia and St. Vincent. Although Mr. Jones' term of office as Commissioner of Agriculture has been cut short, sufficient time has elapsed for him to see many of his efforts in the Islands crowned with success.

Mr. Jones' wide knowledge of West Indian agricultural problems led to his selection in 1929 as agricultural adviser to the Olivier Sugar Commission, and in 1937 as a member of the Royal Commission of Enquiry in Trinidad. The valuable services rendered by him on these commissions and in the cause of the advancement of agriculture and social conditions in the West Indies have been recognised by His Majesty the King, who was graciously pleased to confer on him the Honour of Companion of the Order of St. Michael and St. George on the occasion of His Majesty's birthday in 1938.

Mr. Jones' cheerful personality, his great gift of tact and charm of manner, have rendered him eminently suitable for his duties as Commissioner

of Agriculture and have won for him a high sense of respect and a wide circle of friends. As a senior officer he was never lacking in courtesy, he was always easily approachable, and never failed to give the most careful consideration to every point of view. His partner in life was drawn from the ranks of a distinguished family in the Leeward Islands, the Islands which it has been his privilege to serve for the greater part of his career. His selection as director of agricultural development of Jamaica at a time when that Colony is confronted with serious problems of economic depression and social reconstruction, is proof of his character, organizing ability and energy. His many friends in the Windward and Leeward Islands and in Trinidad will join with us at the College in wishing him continued success in his new sphere of work.

C. C. S.

REVIEWS

SCIENCE IN AGRICULTURE.

By John W. Paterson, B.Sc., Ph.D., *Longmans, Green & Co.*, London, 1938. pp. 288, *price* 6*s.* 6*d.*

As the title indicates, this is a text-book describing the scientific principles from which good farm practice in many of its different facets has been evolved. The treatment and style have been kept simple and elementary, so as to render the text comprehensible to readers without any previous scientific training. The subject is tackled from a new angle, in that the why and the wherefore of agricultural practice is discussed and not the actual field technique itself. The ground covered is satisfactorily extensive. The opening chapters deal with the elementary facts of Natural Science as related to the atmosphere, climate, soil, plant structure and physiology. Then the various organic and inorganic fertilisers are considered and their action in the soil and on plant growth. The physical character of the soil is next discussed in greater detail with particular attention to soil water and its control so as to produce optimum conditions for plant growth. From this point, the book tends to deviate somewhat from the original objective and to develop into an elementary text book on English agriculture, discussing very briefly and in consequence rather inadequately cultural methods, stock, crops and their more common diseases and pests.

In his preface, the author points out that in most secondary schools and colleges to-day, scientific training in one form or another is taking an increasingly important part of the curriculum, and that it would be possible to give a practical impetus to such studies without loss of tuitional value if they were more closely linked to the ordinary operations of the farm and of rural life in general. For those who ultimately have to make their living from the land, the natural science class would then serve as the first stage of their vocational training, and for the others it should increase their interest in, and understanding of, the problems of country life. This idea is well worthy of support, and the author has provided science teachers with plenty of material for developing their studies along the lines suggested. With the idea of presenting a clear black and white picture of his subject, he has rightly confined himself to the discussion of proven theories and principles, though occasionally he has laid himself open to the criticism that his generalisations are too sweeping and would not bear close scientific analysis. The treatment is such that the book is suited primarily for pupils of secondary schools and as a reference for country dwellers who seek an explanation of the scientific reasons underlying the various operations of the farmer's daily routine. For these classes of students, it can be thoroughly recommended as a sound and easily assimilated introduction to agricultural science.

D.D.P.

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INSECTS OF CITRUS AND OTHER SUBTROPICAL FRUITS.

By Henry J. Quayle, *Comstock Publ. Co. Inc.*, Ithaca, New York, 1938. pp. 583, 337 figs.

Professor Quayle is a member of the Entomology Department of the University of California Citrus Experiment Station at Riverside, in Southern California. The Station has played an important part in the progress of agricultural entomology, especially in biological control, the fumigation of trees and the use of petroleum oil sprays. The publication of this book adds to the achievements and reputation of the Station, because of the merits of the book and because so much of our knowledge of citrus pests and so many of the methods of controlling them are the results of work done at this Station. The book can be highly recommended both to practical agriculturists and to entomologists in all parts of the tropics and subtropics.

Citrus insects occupy about half of the book. Short chapters are devoted to those of eleven other fruits: avocado, vinifera grape, Persian walnut, almond, pecan, fig, olive, date, oriental persimmon, pomegranate and sweet cherry. The natural enemies of the pests of these crops are of course dealt with in almost as much detail as the pests themselves, because of the importance of biological control of citrus pests, especially in California. There is an excellent chapter on the tent fumigation of trees with hydrogen cyanide—a method developed in California—and one on spraying and dusting. The book is profusely illustrated by drawings and photographs of exceptionally high standard.

Turning over the pages of this volume gives the impression that everything worth knowing about citrus insects and their control has been included. Professor Quayle has made full use of the work done in California and at Riverside in particular, but this has not caused him to

neglect other countries. He writes from long personal experience with most of the world's major pests of citrus, because he has travelled widely and because so many of these pests have acquired a very wide distribution, occurring now in Florida, Palestine, South Africa and other countries as well as in California.

A. M. A.

* * *

THE S. A. SUGAR YEAR BOOK.

South African Sugar Journal, Durban. Price 5*s*. 1938. pp. 296.

This reference book and guide to the sugar industry of South Africa now appears for the ninth year. It is pleasant to note in the new edition that the long list of names constituting the directory and telephone guide has been omitted. The Milling Enterprises section, however, retains the useful feature of listing the more important officials at each of the factories or estates. Although the book is well indexed, there is no "Contents" page and it takes one a few minutes at least to find one's way about. It is suggested that such a page might be added to future editions.

After Forewords by various prominent men and extracts from reports, &c., of the different Associations, the text of the International Agreement is reproduced. Then follows a description of Factory Improvements, and other useful information pertaining to the South African industry, including a history and progress of the various sugar milling companies, factories and estates, the constitution of mill groups and associations and Malaria committees, and statistical information. Finally, there is a supplement which records the activities of local and overseas firms who are associated with the sugar industry. The S. A. Potash Co. retains the right to supply the book marker. It is the same form as in previous years.

The printing and finish, and method of presentation of the facts and information in this book are improving every year and we wish the enterprising editor of the S. A. Sugar Journal continued success with this publication.

J. G. D.

* * *

PRACTICAL REPLANTING OF RUBBER.

By E. W. Whitelaw. *The Times of Ceylon Co., Ltd*. Colombo and London. 1938. pp. 102.

The book deals with one relatively small part of the business of the rubber planter; and it is interesting evidence of the degree to which this science and art is being developed. It thus marks the contrast between rubber culture and some others to-day. It deals with such highly technical matters that adequately to comment on every chapter would call for a staff of reviewers comparable with the staff of the Rubber Research Institute of Malaya. The present reviewer, with some little knowledge of the recent work and of the technical opinions of that Research Institute and of other rubber growing experts of that country, can only say that the practices advocated in the book seem to be generally in accordance with the latest opinions of the Malayan pundits. Perhaps the author goes a little further in places than the technical experts would be prepared to go on paper; but even then, he is seldom in conflict with the ideas and theories which the rubber scientists would describe as "probable but not yet proven".

This book forms an extremely detailed practical guide for the estate manager who has to embark on a programme of replanting; and it will also be read with great interest by visiting agents and by those directors who try to keep up to date with the technical details of the business of the companies they direct.

The title perhaps does less than full justice to the contents, in that it might not convey to everyone that this is a treatise not only on replanting but also on the vegetative reproduction of rubber. The author obviously named it only "Replanting" because to him, as to most rubber planters, practical replanting, whatever it may mean at some future date, to-day means replanting with vegetatively reproduced material. The book actually deals as fully with the merits of the various available clones and other such subjects cognate to vegetative reproduction as it does with the details and costs of the field operations of replanting.

O T. F.

* * *

FOREST BIBLIOGRAPHY TO 31ST DEC., 1933.

Part III, compiled and published by the *Department of Forestry, University of Oxford*, Oxford 1938, pp. 74.

It may be as well to remind readers who are interested in forest literature that this Forest Bibliography contains a list only of the periodicals, bulletins, reports and other material to be found in the library of the Imperial Forestry Institute, and does not include any mention of the books contained in the library.

Part III is devoted to Forest Protection, which has been sub-divided into the following subheads:—1.—Man; 2.—Animals; 3.—Atmospheric Influences; 4.—Fire; 5.—Weeds; 6.—Other Agencies; 7.—Fencing.

Under 6.—Other Agencies, is included:—floods, swamps, shifting sands, avalanches, landslips, &c.: reclamation works, including protective afforestation. Erosion in every form is of interest as much to agriculturists as to foresters and constitutes a problem of major importance in most countries today: this list of relevant literature may, therefore, well be brought to their attention.

R. L. B.

AGROBIOLOGY.*

PHILOSOPHERS of old employed themselves in such, to us, fruitless discussions as how many angels could dance on a pin's point. Modern progress has offered subjects for like discussion, but of a different type. The characters which, in their sum, form the plant are now known to be the expressions of definite particles, the genes, carried in the chromosomes, and the plant may be considered to be built up of a number of such characters. If a particular gene is absent, the plant will not develop the corresponding character. The philosophical problem here is: What happens to the plant when all the genes are absent? A similar problem arises from the study of the limiting factor of plant-growth. Until recently, the accepted view with regard to growth was that some influence or factor, a constituent of plant-food, water, and so on, limited growth independently; that it was only necessary to determine the nature of the limiting factor and to remedy the defect with a resultant increase of growth. If all the factors were present in adequate amounts there would be no limit to growth, and the interesting problem for the philosopher was: What happens to a plant so supplied?

It is the Agrobiologist who has given the answer to this problem. He has removed it from the sphere of philosophical speculation. He has shown that each plant is endowed with a definite "quantity of life" which places an equally definite limit to its growth. The demonstration of this is given by the culture of plants in media which contain all the requisites for full growth except one. It has been found possible to determine a unit (dose) of the missing requisite such that, by the addition of successive doses to a series of such cultures, the respective yields (weight of dry matter) will form the series y (the yield from one dose), $(1+\frac{1}{2})\,y$, $(1+\frac{1}{2}+\frac{1}{4})\,y$, and so on. This is a series, the sum of which is $2y$. The maximum yield is, thus, twice the yield given by such a single dose. Such a unit is termed a Baule unit, and the resultant yield from one unit is 50 per cent. of the maximum.

It is not possible here to follow this basic conclusion in all its implications; it has been shown that the Baule unit for any particular requisite is a constant for all plants, and that such units may be determined for each of the various requisites. Those desirous of following these arguments will find a simple account in a recent book.† To the planter it will appeal as giving a limit to which he may aspire. Those limits are likely to make his mouth water. Thus, for sugar-cane, the theoretical yielding ability is 190 tons to the acre; Australia and Hawaii have shown how closely that limit may be approached.

But if these limits are possible, it will be a long time before they are likely to be approached on a commercial scale. By definition, each additional Baule unit, say of nitrogen, is responsible for one-half the increment of the preceding unit and, as a practical maximum, 10 Baule units are required for a full crop (actually 1023/1024ths of the theoretical maximum). The nitrogen unit is 225 lbs. per acre. A time soon comes when the cost of additional nitrogen exceeds the value of the diminishing increment. There is, too, a time factor. The plant requires access to the supplies of its requirements at each stage of its growth, and such a regulation of supply is not easily provided, witness water. Again, some requirements, notably water, may at times be present in harmful excess. The agrobiologist recognises that the extent to which plants will make use of the food offered to them will depend very largely on other circumstances such as the alkalinity or acidity of the soil, the length of the growing season, and so on. He recognises, too, that pests and diseases must be controlled. Knowledge of these factors is an essential part of the planter's equipment and he must know how to control them.

Not the least interesting chapter of the book deals with the status of public soil science in the United States. It is suggested that official organization there has largely followed a false trail, and draws comparison with the work carried out in Hawaii by the sugar producers. There the soil analysts, 150 in number are costed out against the industry; tangible results are expected and obtained; results which prove to the satisfaction of the industry that the investment is a profitable one. An official organization is subjected to no such crucial test.

One last reflection may be mentioned. Plant-growth is treated by the agrobiologist as a direct response to food supplies, certain external conditions being assured. It is hardly possible that life can be so simple. It is not so long since that the physiologist interpreted the adequacy of an animal diet by calculating the energy value of the food supply; those subtly acting bodies, vitamins, were a later discovery. There are not wanting signs that the plant also is subjected to equally subtle forces. Not only the amount of food supplied, but the form of that supply, appears to have an influence. Plant-food presented as humus appears to impart a vigour often taking the form of resistance to disease, which artificials do not. The explanation is elusive and hardly to be ascribed to direct physical action on the soil.

H. M. L.

*Reproduced from *Int. Sugar Jr.*, Vol. XL, No. 473, p. 174, 1938.

† The A.B.C. of Agrobiology. By O. W. Willcox, *George Allen & Unwin*.

The Editor requests that any subscriber who fails to receive *Tropical Agriculture* regularly should communicate with him immediately in order that the matter may be rectified.

WEST INDIAN NOTES.

(Compiled by the Advisory Department, Imperial College of Tropical Agriculture.)

The Sea Island Cotton Industry.

The third ordinary general meeting of the West Indian Sea Island Cotton Association (Incorporated) was held at the Imperial College of Tropical Agriculture in November, 1938. The meeting was conducted under the chairmanship of Mr. G. A. Jones, Commissioner of Agriculture, whose term of office as President of the Association came to an end on his assumption of the duties of Director of Agriculture, Jamaica, in December, 1938. Representatives of all the Island Cotton Associations, the Principal of the Imperial College of Tropical Agriculture and the Cotton Adviser to the Commissioner of Agriculture, who are honorary members and Mr. F. A. Squire, Entomologist, Cotton Pests Investigation, Windward and Leeward Islands, attended the meeting.

Reference is made in the following paragraphs to the more important matters considered at the meeting and to the more important decisions and recommendations made by the Association.

Reports on the work of the previous year were presented by the Board of Directors and by the Advisory Committee in England. The former indicated that actual production of Sea Island cotton had fallen short of estimated production owing mainly to the partial failure of the crop in Montserrat. It referred to the activities of the Association in the West Indies which included the maintenance of advertisement booths in Barbados and Trinidad, the transmittal of market information to the Island Cotton Associations and the financial support given by the Association to the cotton breeding station in Montserrat. The report of the Advisory Committee indicated that the more important matters which engaged the attention of the Committee during the year were the administration of the trade mark, the investigation of cases of misrepresentation of cotton goods, the advertisement of Sea Island cotton at the Empire Exhibition at Glasgow and the collection of information relating to the production and marketing of American grown Sea Island cotton.

Acting on the advice of the Advisory Committee in England, the Association recommended the Island Cotton Associations to adopt a policy of restriction of production and export in their respective Islands in accordance with the allocations set forth in Table I. The representative of the Barbados Cotton Growers Association recorded the right on behalf of his Island, to resume cotton production in that Island in the event of the accumulation of a large unexportable surplus of sugar.

Table I.

Island	Production in 1939 and 1940. lb.
Anguilla	30,000
Antigua	150,000
Barbados	Nil.
Montserrat	600,000
Nevis	300,000
St. Kitts	200,000
St. Vincent	400,000
British Virgin Islands ...	10,000
Total	1,690,000

Mr. Squire reported his findings and recommendations resulting from the first two years of his investigations. The Associations paid tribute to Mr. Squire for the very definite and rapid progress of his investigations which had enabled him to arrive at important conclusions. The meeting accepted in principle that the only practicable method of controlling pink bollworm lay in the strict application of an annual close season and the removal of all means of survival of the pest. Moreover the meeting was satisfied that the application of biological methods of control appeared at present to offer no practical solution of the problem. The meeting agreed that adequate and sufficient control of pink bollworm could only be realized in practice by the strict enforcement by Governments concerned, with the active support of Island Cotton Associations and cotton growers, of all regulations designed to control the pest. The Association accordingly decided to recommend the adoption of an annual planting season for cotton strictly limited to two months and of an annual close season not less than three months.

The meeting gave careful consideration to information submitted on the subject of the effect on the cotton industry in the British West Indies of the revival of Sea Island cotton production in the U.S.A. and adopted the following resolution :—

"Whereas the production of Sea Island cotton in the United States of America receives financial assistance from the Agricultural Adjustment Administration, which is in effect the equivalent of a subsidy ;* and whereas cotton so produced

* The Advisory Committee in England has subsequently informed the Association that in its opinion the evidence available does not support the claim that the American Sea Island cotton industry is subsidised. The Secretary of the West India Royal Commission has been requested to amend the Resolution submitted to the Commission accordingly.

is now being imported free of duty and sold in the United Kingdom in competition with West Indian Sea Island cotton on which an import duty of seven cents per pound is imposed in the United States of America; and whereas the West Indian Sea Island Cotton Association and other interested organizations have spent considerable sums of money in advertising to obtain a market for West Indian Sea Island cotton; and whereas the growers in the British West Indies have limited their production with the object of adjusting supply and demand;

"Be it therefore resolved that the Secretary of State for the Colonies be asked to take all possible action to protect the British growers of Sea Island cotton."

A copy of the resolution has been forwarded to the West India Royal Commission and also to the Advisory Committee in England, with the request, in the latter case, that it be transmitted to the Secretary of State for the Colonies.

Mr. J. B. Hutchinson, Cotton Adviser to the Commissioner of Agriculture, addressed the meeting and pointed out the part which can be played in the breeding policy and control of commercial types of cotton by spinning tests on samples of cotton grown in the various Islands.

The President emphasised the urgent necessity for adequate funds for advertising Sea Island cotton and strongly urged the Association to recommend the re-establishment of the original rate of the levy as soon as possible. The meeting agreed that more funds were needed and decided that the delegates should invite their respective Island Cotton Associations to recommend an increase in the rate of the export levy to three-quarters of a cent per pound with effect from 1st January, 1939.

The meeting accepted the invitation of the Barbados Cotton Growers Association to hold the next annual general meeting in Barbados in November, 1939.

The Banana Industry.

The number of Gros Michel bananas sold in 1937 and 1938 to the Canadian Banana Company from the Islands of the Eastern Group of the British West Indies is set forth in Table II.

The total number of stems sold to the Company very closely represents total production less the number which fail to reach the standard required in size, maturity and condition and are for such reasons rejected. It will be seen that there has been a decrease in 1938, when compared with 1937, in the total number sold in each Island except in the case of St. Lucia. The number of stems sold but not shipped and therefore left in the Islands for disposal in the local or inter-Island market amounted to three times the corresponding number in 1937.

The leaf spot disease *Cercospora musae* has been found in all the Islands mentioned in Table II, with the exception of St. Lucia. There has, however, been no apparent spread of the disease in the smaller Islands during the past year.

TABLE II.

Statement of Number of Stems of Bananas sold to the Canadian Banana Company and exported from the Islands in the Eastern Group during 1937 and 1938.

	Trinidad.		Grenada.		St. Vincent.		St. Lucia.		Dominica.		Total.	
	1937	**1938**	**1937**	**1938**	**1937**	**1938**	**1937**	**1938**	**1937**	**1938**	**1937**	**1938**
Nines ...	64,256	45,418	60,321	59,517	14,782	13,547	36,141	40,441	35,671	29,714	211,441	188,637
Eights ...	50,790	26,476	44,988	27,988	24,208	14,292	40,604	38,412	39,370	22,138	199,960	129,306
Sevens ...	42,754	11,162	43,890	18,800	24,040	14,628	32,014	16,848	31,232	13,780	173,930	75,318
Sixes ...	—	—	1,976	—	1,316	—	648	—	88	—	4,028	—
Total stems exported ...	157,870	83,056	151,175	106,305	64,346	42,467	109,407	95,701	106,361	65,632	589,359	393,261
Equivalent counts ...	123,996	70,856	116,501	89,908	45,287	31,580	82,763	77,724	80,611	53,207	449,158	323,275
Percentage counts ...	78	85	77	84	70	74	75	81	76	81	76	82
Stems purchased but not shipped	12,757	48,672	5,904	29,976	11,142	32,804	17,555	53,149	27,651	61,445	75,009	226,046
Total stems purchased	170,627	131,728	157,079	136,281	75,488	75,271	126,962	148,950	134,012	127,077	664,368	619,307

Brevities.

Mr. P. E. Turner, Sugarcane Agronomist, visited St. Kitts and Antigua in January, 1939.

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The Acting Commissioner of Agriculture left Trinidad on 17th January for a tour of the Leeward Islands.

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Mr. H. L. Manning, Cotton Research Officer, St. Vincent, visited Trinidad for six days at the beginning of December, 1938.

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The Acting Commissioner of Agriculture visited St. Lucia from 18th to 30th September, and St. Vincent from 7th to 13th December, 1938.

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Captain H. V. M. Metivier, Officer-in-Charge of the Government Stock Farm, Trinidad, paid a brief visit to St. Lucia on 26th and 27th November, 1938.

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Mr. W. R. E. Nanton has been appointed to act temporarily as Assistant Agricultural Officer in Montserrat in place of Mr. S. A. Schouten who has been seconded for service in the peasant agriculture survey scheme.

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The fourth half-yearly progress report submitted by Mr. F. A. Squire, Entomologist, Cotton Pests Investigation, Windward and Leeward Islands was circulated in January to the Governments and Cotton Associations concerned.

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Mr. G. A. Jones, C.M.G., Commissioner of Agriculture left Trinidad on 6th December, 1938, to take up his duties as Director of Agriculture, Jamaica. Mr. C. C. Skeete assumed the duties of Acting Commissioner of Agriculture on Mr. Jones' departure.

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Mr. J. B. Hutchinson, Geneticist Cotton Research Station, Trinidad and Cotton Adviser to the Commissioner of Agriculture visited St. Vincent from 18th to 24th January. He was accompanied by Mr. R. A. Silow, Assistant Geneticist at the Cotton Research Station.

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Professor C. Y. Shephard, Carnegie Professor of Economics at the Imperial College of Tropical Agriculture, left Trinidad in January to begin his survey of peasant agriculture and land settlement in the Windward and Leeward Islands. Antigua has been selected as the first Island to visit. Mr. A. H. Giuseppi and Mr. S. A. Schouten have been appointed as survey officers under the direction of Professor Shephard.

Mr. R. G. Fennah, Entomologist, Citrus Pests Investigation, Windward and Leeward Islands, returned to St. Lucia from leave in October and made a short visit to Trinidad early in November. He proceeded to Montserrat at the end of December and will visit Dominica before returning to St. Lucia.

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Mr. F. A. Squire, Entomologist, Cotton Pests Investigation, visited Puerto Rico in October to observe the methods being employed in that Island in the attempt to effect the biological control of pink bollworm of cotton. Mr. Squire attended the third ordinary general meeting of the West Indian Sea Island Cotton Association in Trinidad in November and later returned to St. Vincent.

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The undermentioned animals were purchased at the annual livestock sale at the Government Farm, Trinidad in December, 1938 for shipment to the Windward and Leeward Islands. With the exception of two boars purchased at the request of the Government of St. Lucia all animals were purchased at the request of private individuals.

For St. Vincent.

3 purebred Berkshire pigs (sows).
2 halfbred Holstein-Zebu heifers.
1 Zebu bull.

For St. Lucia.

2 large Black pigs (boars).

For St. Kitts.

2 three quarter bred Holstein heifers.
1 three quarter bred Holstein bull.

INSECT TRANSMISSION OF MAIZE STREAK VIRUS.

Some interesting results of experiments on insect transmission of maize streak virus have recently been published by H. H. Storey (*Proc. Roy. Soc.*, B, 125, 455-477; 1938). Special attention has been given to the part played by puncture of the plant's tissues by the insect *Cicadulina mbila*, in transmission. It seems necessary, in this particular host-virus combination, for the insect's proboscis to reach the phloem tissue in the host, and infections fail if this degree of penetration is prevented artificially. Punctures maintained for less than 5 min. fail to infect, and it is concluded that the insect inoculates virus in distinct doses. Each dose appears to be independent in its effect of any other doses inoculated by the same or another insect. The vector can take up virus from the mesophyll in a chlorotic area of a diseased leaf, but cannot take it up from either the mesophyll or phloem of a green area. Probability of infection, moreover, is not diminished by the removal of inoculated leaf tissue shortly after the inoculation, so the virus must spread with considerable initial rapidity.—(*Nature*, Vol. 142 No. 3604, p. 962, 1938.)

SUGAR NOTES.

Compiled by the College Department of Sugar Technology.

Bagasse Cellulose Pulp.

The first bagasse cellulose pulp containing over 90 per cent. of alpha-cellulose was produced in 1925 by Jaoquin Julio de la Roza, Sr., who later made it in a purity of 95 per cent. He has taken out a number of patents covering the material and the process of making it.*

Extremely white bagasse cellulose pulp containing as much as 98 per cent. of alpha-cellulose (with 0.025 per cent. only of ash and 0.6 per cent. of pentosans) can be produced by the de la Roza acid-alkali, double-digestion process. This is carried out in two steps, the first of which employs plain acid, preferably sulphurous, and the second plain alkali, preferably caustic soda.

In practice, the bagasse is digested with five times its dry weight of sulphurous acid containing 6 per cent. of SO_2 at 110°C. for 2 hours, washed thoroughly, again digested with 3½ times its dry weight of caustic soda containing 10 per cent. of sodium hydroxide by weight at 140°C. for 2 hours, and again washed thoroughly with water. It is then bleached.

There is nothing difficult about this process, and any chemist can try it out on the small scale with the simplest of apparatus, the main item of which is a small digester which can be made in every shop, together with the standard equipment found in the chemical laboratory.

The choice of the proper plant for the chemical treatment of the bagasse is important. Many years of experience have shown the impracticability of using standard wood-pulp batch digesters for this purpose if the highest quality is to be made. This has brought about the invention and development of the de la Roza continuous digester.

This a very simple piece of equipment. It consists of an impregnating feeder press, a long horizontal rotating digester, two pulp presses, and heating, measuring, recording and controlling auxiliary equipment. With materials varying widely in water content, an equalizing press must also be used.

Bagasse, being very light and bulky, requires a digester several times the capacity of that sufficing for wood; but the continuous digester will digest up to four times as much bagasse per cubic foot of digested capacity as can be digested in any batch digester.

Moreover, this apparatus is claimed to produce perfect cellulose pulp with very much smaller quantities of chemical solutions than can be used in any batch digester. It further enables two cooks to be carried out with much greater efficiency and with lower steam consumption and total costs than a single cook in a batch digester.

Bleaching (in two stages, using hypochlorite) and sheeting of the bagasse cellulose pulp can be carried out by standard processes and equipment. In short the conversion of bagasse into cellulose pulp by the de la Roza continuous process and plant is both practical and profitable, and is said to present no technical difficulties of any kind.—(*Int. Sugar Jr.*, Vol. XL., No. 480, pp. 473-74, 1938.)

* * *

Treatment of Alkali Soil by Molasses. *By N. R. Dhar and S. K. Mukerji.*

It is estimated that the total area of "usar" lands (salt-alkali tracts) in the U.P. is more than 4,000,000 acres, the reclamation of which is a matter of great interest to the crowded population. The alkalinity runs as high as 10.8 pH, and cultures of these soils show neither *Azotobacter* nor nitrate-forming organisms. They contain less calcium than normal soils; the nitrogen content is small (0.008 to 0.02 per cent.); and the soil is highly impermeable to water.

Alkaline lands are said to have been successfully reclaimed near Cawnpore and in Mysore by the application of molasses at the rate of one ton per acre, and good crops have been grown in these reclaimed areas where no vegetation grew before. The action of molasses is ascribed to the fact that it contains large amounts of fermentable carbohydrates, which on final fermentation produce organic acids that neutralize the alkali, besides contributing appreciable quantities of nitrogen, phosphoric acid and potash, together with some lime salts.

The reclaiming effect of molasses is much quicker than that of either gypsum or powdered sulphur. It has been reported that four years are necessary for reclaiming alkali land with gypsum, but with molasses four to six months are quite adequate. Using one ton of molasses per acre of alkaline land, the Mysore Agricultural Department has been able to grow 1,200 to 1,800 lb. of rice where before no rice crop could be grown.

Press mud from sugar factories containing large proportions of carbohydrates and calcium compounds is also very useful for the reclamation of "usar" lands. Where alkali conditions are very bad, from three to ten tons of molasses may be used; 300 tons applied to 100 acres of alkaline rice land have given very good results. The best time to apply the molasses is during the rains.

An important effect of molasses is that it stimulates the action of nitrogen-fixing organisms; field experiments show that by adding three tons of molasses per acre, 112 lb. of nitrogen (equivalent to about 500 lb. of ammonium sulphate) were added to the soil. It is acknowledged that the principal difficulty with this use of molasses is the cost of transport, but this is of less importance in the immediate neighbourhood of the factories.—(*Int. Sugar Jr.*, Vol. XL, No. 478, p. 398, 1938.)

* *See* U.S. Patents, 1,817,972-3; 1,825,655; 1,862,177; 1,864,985; 1,918,250; 1,993,575; 1,991,243-4-5; 2,011,799; 2,063,367; 2,063,368; 2,067,480 and 2,072,086.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

Cloudiness in Fruit Juices.

An article entitled "The Processing of Fruit Juices," written by V. L. S. Charley of the Long Ashton (Bristol) Fruit Research Station, appeared in the Journal "Food", for December, 1938. It describes the significance of each of the chief components (sugars, acids, pectins, tannins, essential oil) in the preservation and development of flavour, aroma, appearance and keeping qualities of the juices of the commoner temperate fruits and of citrus fruits.

A constant source of trouble in fruit juices is cloudiness and the slow separation of a slimy precipitate which spoils the appearance of the bottled products. The trouble arises through chemical changes affecting the pectin component. Pectin occurs in the cell walls of fruits in combination with cellulose. During maturation, the two become separated through hydrolysis, and the pectin dissolves in the fruit sap, conferring high viscosity to it. The dissolved pectin is liable to further chemical change, whereby it becomes progressively de-methoxylated, giving rise to degraded products that have non-colloidal properties. Certain of these products, being insoluble, are responsible for the cloudiness and sediment in stored fruit juices. In order to eliminate them, the juices should be stored long enough for the acids and enzymes naturally present in them to effect complete de-methoxylation of the pectin.

In recent years, pectin-decomposing enzymes have been introduced for addition to fruit juices so as to expedite pectin destruction and thus to minimise the storage time needed for the preparation of clear, unclouded products. One of these enzymes ("Pectinol") is now produced on a commercial scale. The mould *Penicillium glaucum* produces a pectin-splitting enzyme (pectase) during its active growth in a suitable nutrient medium, and this organism may be employed in the preparation of a pectase. A preliminary fermentation may act as an alternative to pectase enzyme action, and soft-fruit juices (including citrus juices) benefit particularly therefrom.

Other factors discussed are the rôle of tannins, nitrogenous compounds, oxidases and essential oils in palatability, and the variations in the amount of ascorbic acid (Vitamin C) that occur in fruit juices.

* * *

Casein Fibre.

Stephen P. Gould and Earl O. Whittier of the Bureau of Dairy Industry, United States Department of Agriculture, have completed the first steps towards the development of a process for making a synthetic fibre from casein by a process which differs from those that have been in use abroad.

While the final product is quite similar to Lanital made in Italy and differs from natural wool principally in having a lower sulphur content the process uses as raw material far more grades of casein than any heretofore developed. The casein fibre has the characteristic fine kink of natural wool, with which it may be blended, producing a fabric that has the resilience of pure wool. The casein fibres will take wool dyes and by varying steps in manufacture the fibre may be either soft or harsh to the touch.

It is estimated that if desirable the skim milk available in the country would make possible the production of a billion pounds of casein annually. In the process, casein softened in water and dissolved in caustic alkali is carefully worked into the desired consistency by aging, the addition of modifying agents, and dilution. The prepared mass is forced through spinnerets and the fibres are hardened in an acid bath containing formaldehyde and modifiers.

Application has been made for patents.—(*Ind. & Eng. Chem., News Edit.*, Vol. XVI, No. 19, p. 525, 1938.)

* * *

Sugar from Coloured Cane.

As a result of laboratory experiments, it has been found that aluminum hydroxide completely precipitates the anthocyanin pigments which interfere with the production of white sugar from coloured canes, such as Purple Mauritius. Lime and sulphur dioxide are first utilized to remove the larger impurities from the juice. The amount of aluminum hydroxide required for pigment removal alone is small and therefore its use appears to be economic. Aluminum hydroxide, produced by the addition of lime to commercial potash alum and washing out the calcium sulphate produced by the double decomposition, is inexpensive and has been tried on a factory scale. The cane juice did not undergo an appreciable chemical change and the sugar produced was bright, lustrous, transparent, and completely devoid of colouring material and colloidal particles.—(*Ind. & Eng. Chem., News Edit.*, Vol. XVI, No. 19, pp. 530-31, 1938.)

* * *

Utilization of Cacao Shells.

The cacao shells falling as waste from the chocolate industry make a suitable nutritive substrate for yeast production. G. Pfeiffer, of Bonn, has applied the shells in the biological synthesis of protein. With the supplemental utilization of fermentable carbohydrates and mineral stuffs it is possible to produce a more or less rich protein material suitable for animal feed. At the same time the bitter principle of the shells is consumed by the growing yeast. The analysis of the shell-yeast feed on the dry basis shows 28.3 per cent. of crude protein (purified 22.9 per cent.), 17.3 per cent. of digestible crude protein (purified 11.5 per cent.), and 6.5 per cent. of crude fat. In nutrient content this material resembles a nourishing feed.—(*Ind. & Eng. Chem., News Edit.*, Vol. XVI, No. 24, p. 670, 1938.)

TREND OF THE MARKETS.

[The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.]

SUGAR.—Prices on the Home Markets have ranged as follows (c.i.f. per cwt.):—

	Foreign.		*Preferential.*	
	s.	*d.*	*s.*	*d.*
24th November ...	5	10½	9	7½
1st December ...	5	9¾	9	6
8th December ...	5	11¼	9	8¼
15th December ...	6	1½	9	9
22nd December ...	6	3	10	0
29th December ...	5	6	10	0¾
5th January ...	5	6	10	0¾
12th January ...	5	6	10	0
(13th *January*, 1938)	6	1½	9	10½

The period under review has seen a more pronounced advance in the general upward movement of sugar prices. There has been a good demand for raws and refined. Recent purchases of raws in particular have disclosed the extreme firmness with which first-hand sugars are being held and has brought a fuller realisation of the improvement which has taken place in the general position of the article during the Convention year. Licht's reduced European beet estimate has also brought renewed activity to the market.

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RUBBER.—Quotations for Plantation Sheet have ranged as follows:—

	Pence per lb.
30th November	7 15-16
7th December	8
14th December	8 1-16
21st December	8 1-16
28th December	8 3-16
4th January	8 3-16
11th January	8 7-16
(12th *January*, 1938)	7 1-8

Since our last report there has been little business done on the market and quotations have varied only slightly. In spite of an increased consumption of rubber in America and a heavy decline in world stocks there has not so far been any substantial improvement in values. However, if the statistical position continues to improve as it has been doing recently, it is expected that the market will react favourably. American consumption for November at 46,048 tons was better than expected. Reports from the motor industry are also encouraging.

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COFFEE.—Kenyas have shown a decided improvement and have met with a better general demand, A sizes realising 65*s.* 6*d.* to 111*s.* per cwt. and B sizes from 60*s.* to 66*s.* per cwt. London cleaned Tanganyika (Mbeya) bold sizes fetched 66*s.* per cwt. and second sizes from 58*s.* to 62*s.* per cwt. First offering of new crop Costa Rica sold rather disappointingly at 65*s.* Santos Superior 33*s.* cost and freight; Rio 7, 23*s.* 3*d.*

COTTON.—The following are the official spot prices in pence per lb. of the Liverpool Cotton Association.

	American Mid.	*Egyptian Giza 7.*	*F.G.F. Sakel.*
25th November ...	5.22	8.21	8.31
2nd December ...	5.14	8.00	8.10
9th December ...	4.97	7.66	7.63
16th December ...	5.16	7.73	7.68
30th December ...	5.25	—	—
6th January ...	5.30	—	—
13th January ...	5.17	—	—
(14*th January*, 1938)	5.02	7.61	8.44

Since our last report prices of raw cotton have fluctuated more widely and at one time declined sharply. Both the New York and Liverpool markets have been affected by the European political views. In U.S.A. the Government has been disturbed by the fall in exports while some dissatisfaction has also been expressed at the effect of the Farm Act. The revised estimate of the U.S.A. crop is 12,008,000 bales. West Indian Sea Island continues in good demand and prices are firm at between 17.5*d.* and 19*d.* per lb.

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COCOA.—Latest cable advices from Accra state that a Committee has been appointed to make recommendations on the Cocoa Commissioner's report. The Committee is to examine a cocoa marketing scheme and the practicability thereof, as well as the cost of bringing it into operation. The advisability of licensing buyers, buying stations, and daily circulation of prices through outlying districts is also being investigated. The price of Accra is quoted at 21*s.* 6*d.* c.i.f. and of local Plantation Cocoa at $5.70 per fanega. —(*By Courtesy of the Cocoa Planters' Association of Trinidad, Ltd.*)

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LIME PRODUCTS.—*Lime Oil.*—Hand pressed has been neglected, the nominal value remains unchanged at 30*s.* per lb. *Distilled.* Sellers at cheap rates are still depressing the market. *Lime Juice.*—There is still no demand for Concentrated, raw is unchanged at 1*s.* 9*d.* to 2*s.* 3*d.* per gallon.—(*West India Committee Circular*, 15th December, 1938.)

* * *

COPRA.—The market remains steady, with the price of West Indian f.m.s. quoted at £10 10*s.*—(*West India Committee Circular*, 15th December, 1938.)

* * *

BANANAS.—The demand for Jamaicas is not quite so strong at the unchanged price of £18 10*s.* delivered London, and £18 5*s.* delivered nearest station Provinces. Brazilians are 5*s.* higher at £15 10*s.* delivered both London and Provinces.